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# EPA (Environmental Protection Agency) Indoor Air Quality Implementation Plan Appendix C. EPA Radon Program Appendix D. Indoor Air Resource History

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16. ABSTRACT

The "EPA Radon Program" briefly describes the goals, strategy and implementation plan adopted by the Agency for dealing specifically with radon as an indoor air pollutant. This discussion is excerpted from a more comprehensive report, "EPA Interim Report to Congress on Indoor Air Pollution and Radon."

The "Indoor Air Resource History" is a one page summary of EPA resources (funds and personnel) expended on the indoor air program. The summary begins with FY 84 and extends to FY 88 where projected figures are given.

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# EPA Indoor Air Quality Implementation Plan

## Appendix C: EPA Radon Program
## Appendix D: Indoor Air Resource History

Prepared by:

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OFFICE OF RESEARCH AND DEVELOPMENT  OFFICE OF AIR AND RADIATION

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Appendix: C

EPA RADON PROGRAM

(Excerpted from the EPA Interim
Report to Congress on Indoor Air Pollution
and Radon under Title IV
Superfund Amendments and Reauthorization Act of 1986)

NOTE TO READER: Excerpt begins
with page 12

## INDOOR RADON

Radon is a radioactive gas produced by the radioactive decay of radium-226, which occurs naturally in almost all soils and rocks. Radon is present in the atmosphere everywhere due to its release from radium decaying in the ground. Outdoor radon levels generally are low. Typical indoor levels are usually about five times higher than average outdoor levels, but can be over ten thousand times higher. Exposure to such elevated levels may greatly increase an individual's risk of developing lung cancer. Further, since everyone is exposed to radon in buildings, it is believed that radon substantially contributes to the incidence of lung cancer in the United States. The Environmental Protection Agency and other scientific groups estimate that from about 5,000 to about 20,000 lung cancer deaths a year in the United States may be attributed to radon. (The American Cancer Society expects that about 130,000 people will have died of lung cancer in 1986. The Surgeon General attributes around 85 percent of all lung cancer deaths to smoking.)

While the Reading Prong area of Pennsylvania, New Jersey, and New York is the best known high-radon area in the United States at this time, indoor radon is potentially a widespread problem. Elevated radon levels have been found in houses in many States--not only where suspected geological factors or the presence of uranium deposits suggest that radon might be a problem. Preliminary data indicate that perhaps more than 10 percent of the approximately 85 million homes in the U.S. may have radon levels reaching or exceeding four picoCuries per liter--the level recommended by EPA as a target for corrective action. This level was based on both health considerations and on the limitations of current technology in reducing radon levels below this target level.

### A. GOALS

In response to growing concern about elevated indoor radon concentrations in houses situated on the Reading Prong and those located elsewhere, the EPA Administrator established the Radon Action Program in September 1985. The goals of EPA's Radon Action Program are to:

- Determine the extent of the problem. Information is needed not only on the "hot spots" in the United States, but also on the distribution of radon levels in homes throughout the country.
- Reduce exposure to radon in existing homes. The development and demonstration of cost-effective mitigation techniques will, it is hoped, eventually enable homeowners to correct a radon problem as easily as they might correct a water or electrical problem in their home.
- Prevent radon problems in new housing. By addressing the problem in new construction as well as in existing houses, the potential risk to people who live in new homes can be reduced and consequently, the national average concentration of radon in houses can be lowered.

## B. STRATEGY

EPA lacks clear statutory authority to prescribe what homeowners should do about radon. Moreover, it does not appear that a regulatory approach is suitable to deal with this naturally-occurring health hazard. Consequently, the Agency is pursuing its objectives, not by the usual regulatory means (except that it has recently proposed standards for radon in drinking water under the Safe Drinking Water Act[3]), but rather by trying to ensure that the needed technical knowledge exists and that homeowners, contractors, and State and local officials have access to it.

Indoor radon levels can vary greatly not only from community to community, but also from house to house. In addition, the problem areas are widely dispersed throughout most of the country. Therefore, the Agency believes that the primary line of response to the problem should be the State and local governments and the private sector. These groups are in the best position to provide homeowners with the day-to-day support necessary to understand the problem and reduce the risks.

However, EPA and other parts of the Federal government have unique capabilities and expertise to offer the State and local governments and the private sector. Thus, EPA has developed a program that provides for both information development and information delivery. The Agency is developing and disseminating technical knowledge to encourage, support, and facilitate the development of State programs and private sector capabilities in the areas of radon assessment and mitigation. It is acting as a catalyst to bring together the appropriate expertise and responsibilities of Federal agencies, the State and local governments, and the private sector.

The Radon Management Committee (RMC), which is comprised of senior management officials from the various headquarters and regional offices within EPA, was established to provide broad policy advice and guidance to EPA's Radon Action Program and the Administrator. The RMC identified priorities for the FY 1987 radon program, and developed the following consensus ranking of the most important tasks:

1. Identify cost-effective mitigation technology for existing houses.

2. Assist States in developing programs to help citizens understand radon-related health risks and take action to assess and, if necessary, reduce their exposure.

3. Develop information materials that States and private sector groups can use to help citizens and homeowners.

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3 Volatile radon can be transported to indoor air by drinking water that is derived from some groundwater sources. The mechanisms for the release of radon from drinking water to indoor air include: showers, baths, clothes washers, dishwashers, cooking, and flushing toilets. The average contribution from the drinking water source to indoor air radon levels is in the range of one to seven percent.

4. Promote good practices in radon measurement (e.g., use of recognized methods, proficiency in making measurements).

5. Develop training courses and materials useful for governmental and private sector personnel.

6. Assist States in designing and conducting surveys to identify high-radon areas.

7. Conduct a national survey to determine the distribution of indoor radon levels and identify the factors that influence such levels.

8. Share with States and the private sector all available technical knowledge about radon measurement, mitigation, prevention, and other key topics, and help them learn how to use that knowledge.

9. Identify cost-effective prevention technology for new housing.

10. Reaffirm or revise the Agency's estimates of the health risks associated with radon exposure.

In establishing this ranking, the Management Committee agreed that all ten areas are important in achieving the Agency's goals and should be supported to the extent possible.

The Management Committee also recognized the importance of the contributions of other Federal agencies to the overall goals of EPA's Radon Action Program. Consequently, they recommended that a portion of the Agency's efforts be devoted to working with Federal agencies such as the Department of Energy, the Department of Housing and Urban Development, and the U.S. Geological Survey.

## C. IMPLEMENTATION PLAN

To provide a better focus to its efforts, the Agency's radon program consists of five major elements and objectives:

- Radon exposure and health risk: To identify areas with high levels of radon in houses and to determine the national distribution of radon levels and the associated risks.

- Mitigation and prevention: To identify cost-effective methods to reduce radon levels in existing structures and to prevent elevated radon levels in new construction.

- Capability development: To stimulate the development of State and private sector capabilities to assess radon problems in homes and to help people mitigate such problems.

- Public information: To work with States to provide information to homeowners on radon, its risks, and what can be done about it.

- Federal coordination: To take advantage of the expertise, responsibilities and resources in this Agency, the Department of Energy (DOE), and throughout the Federal government in addressing the radon issue and to coordinate the activities of each Agency to maximize the effectiveness of the overall Federal effort.

The following discussion describes the tasks necessary to meet the objectives of the Agency's indoor radon program. Included in this discussion is a brief outline of the progress made to date on each of the activities and a projection of what remains to be done. A crosswalk between the requirements of Title IV and the activities of EPA's Radon Action Program is provided in Appendix D.

## 1. RADON EXPOSURE AND HEALTH RISK

### (a) Conduct a National Assessment of Representative Structure Types and Geographical Locations

The Agency plans to conduct a national assessment to better define the distribution of radon levels in houses across the country and to determine the national average. Existing information on indoor radon levels is fragmented and is very likely to be skewed because a disproportionate number of measurements have been made in known problem areas, such as the Reading Prong. A determination of the distribution of radon levels throughout the United States is essential in determining the risk to the general population from indoor radon.

A design for the national assessment was submitted to the Radiation Advisory Committee of EPA's SAB in September 1986. They offered the Agency some initial recommendations, and EPA is revising the design accordingly. The SAB's final review is expected to be completed by mid-1987, at which time EPA will make the SAB's final report, along with any Agency comments, available to Congress.

The national assessment is likely to involve 3,000 to 5,000 structures randomly distributed throughout the United States. In its initial recommendations, the SAB stressed the importance of obtaining a high rate of participant return to maximize the value of the survey results. In addition, the cost of the assessment has been estimated to range from $300 to $500 per dwelling. These two factors have been influential in determining the number of houses that will be included in the survey. While the sample size planned will yield a good picture of the distribution of radon levels across the United States, it will be minimally useful in assessing the factors which influence those levels, such as geology and house characteristics.

EPA expects to begin deployment of measurement devices in FY 1988. Devices will be placed in houses for a one year period to obtain the annual

average radon concentration in each structure. The survey and the associated data analyses will take approximately two to three years to complete.

Another important feature in determining public exposure to indoor radon is the concentrations found in schools, office buildings, and other non-residential structures. The Agency's national assessment is devoted to private residences, because they are usually the major sources of exposure. However, EPA plans to look at what data exist for other types of structures and to conduct a feasibility study of what needs to be done to provide an indication of the levels in non-residential buildings. The results of this study will be provided to Congress in October 1987, in the Agency's report to Congress mandated by Section 118(k)(1) of SARA.

(b) Provide Technical Assistance to State Survey Efforts

While it is important to determine the national distribution of radon levels, it is also important to locate areas of particular concern. The Agency considered including this objective in the national assessment, but realized that it would be too resource intensive, and the information would not be available soon enough to meet the demand to identify high-risk areas. Therefore, the Agency designed a program to provide assistance to States in conducting their own surveys. The objectives of EPA's State Survey Program are to: (1) find areas of high indoor radon levels; (2) implement consistent survey methods to assure comparable results; and (3) determine how geology can be used to predict high indoor radon levels. Assistance offered by EPA depends on an individual State's needs, but may include survey design, measurement devices (charcoal canisters), laboratory analysis, etc.

Ten States (Alabama, Colorado, Connecticut, Kansas, Kentucky, Michigan, Rhode Island, Tennessee, Wisconsin, and Wyoming) are participating in the survey program this winter. These ten states were selected, from a total of 21 requestors, primarily on the basis of their ability to deploy measurement devices during the 1986-1987 heating season. Ten is the maximum number of States that EPA can provide assistance to at one time. The Agency expects to eventually provide assistance to the other 11 States who requested it, as well as to any future requestors.

While the State surveys will provide more detailed information in a shorter time period than the national assessment, it will be several years before the majority of surveys are completed, the data analyzed, and the reliability of geological factors in predicting high indoor radon levels are determined. However, data from the first ten States will be available this summer and will be incorporated into EPA's Section 118(k) report to Congress.

The national assessment and the State survey program were designed to complement one another and to maximize the effectiveness of the Agency's resources. Completion of these tasks will provide information necessary to better define the distribution of indoor radon levels across the country, and to identify those areas of the United States in which elevated indoor radon concentrations may be a problem. In addition, data gathered through these survey efforts will be used to determine and characterize the factors which may influence such levels.

(c) Develop Models to Predict the Potential for Structures Built on Certain Land Types to Have Elevated Indoor Radon Concentrations

An important adjunct to the survey efforts to identify high-risk areas is the ability to predict the occurrence of elevated indoor radon levels based on models. One can think of this task as a ladder, with the lowest rung being the ability to predict whether large blocks of land, such as the northwestern portion of a given State, might cause high indoor radon levels. The middle part of the ladder would be the ability to predict whether smaller areas of land, such as individual counties, might have an indoor radon problem. Finally, at the top of the ladder would be the ability to predict whether an individual parcel of land might cause high radon levels in a house built on it. This latter piece of information is the most useful, but also the most difficult to obtain.

The Agency presently has a modest effort underway to identify those geological factors and characteristics which are most useful as indicators of high radon levels. EPA also is conducting some preliminary work on the use of soil gas measurements to predict the radon potential for individual parcels of land. This technique appears promising, but is a long way from being a reliable and accurate predictor of high radon levels. Ultimately, work in the area of hazardous land evaluation should yield a model that can predict, on both a macro and a micro level, the potential for a particular area to cause high indoor radon levels.

(d) Develop Measurement Protocols

Since many radon measurements are now done by commercial firms, it is critical that these measurements be comparable and that the public has some assurance that they are being done accurately. To meet this need, the Agency published standardized measurement protocols in February 1986, for seven of the most commonly-used measurement methods. This document was followed by a protocols applications document in September 1986, which outlines the procedures for determining where measurements should be made in a house and under what conditions. DOE is also pursuing improved measurement protocols.

Protocols are needed to ensure that the new devices being developed to measure radon indoors are used correctly. In addition, further protocol applications are needed for specific circumstances, such as epidemiological studies and radon diagnosis for remedial action. Limited work is beginning in these areas.

(e) Conduct Epidemiological and Other Health Studies to Determine the Link Between Lung Cancer and Radon Exposure in Houses

There are many unanswered questions concerning the health effects of radon. Current risk estimates are based on underground miners; however, there is a strong need to establish a link between increased risk of lung cancer and exposure to radon in a residential setting. In addition, there are questions about the risk to children and the potential synergistic effects between radon and smoking.

Several epidemiological studies are planned to address these questions. Two of the larger studies, sponsored by DOE and the New Jersey Department of Health, are just beginning and will be conducted in Pennsylvania and New Jersey, respectively. It is important to note that preliminary results from these studies will not be available for several years because of the latency period associated with lung cancer. Preliminary results from the eastern Pennsylvania study, conducted by Argonne National Laboratory, will be available in 3-5 years.

The Agency is tracking the epidemiological studies now underway, and is identifying study populations and additional epidemiological research opportunities to assess the exposure of the general population to indoor radon. In addition, EPA and the Nuclear Regulatory Commission are sponsoring a study by the National Academy of Sciences to review all existing available data on health risks from radon. The study report is expected to be published in the spring of 1987.

2. MITIGATION AND PREVENTION

(a) Develop and Demonstrate Cost-effective Mitigation Methods to Reduce Radon Levels in Houses

There are four ways to reduce radon levels in a structure: (1) prevent radon from entering a house; (2) ventilate the air containing radon and its decay products from the house; (3) remove radon and/or its decay products from indoor air; and (4) remove the source of the radon. The Agency is conducting a program to demonstrate these various mitigation techniques.

The results to date have been very promising. Our experience, thus far, indicates that the use of techniques that prevent radon entry by ventilating the radon-laden soil gas from under or around the foundations or from within basement block walls is effective. This approach can reduce radon levels by more than 95 percent, even in houses with very high initial radon levels (greater than 1000 picoCuries per liter). The costs of these techniques are expected to range from $100 to $5,000 per home, with an average of approximately $1,000 per home. The costs of radon reduction methods are expected to decrease as more qualified mitigation contractors enter the market. Thus, indoor radon levels can be reduced substantially at a relatively low cost. Our experience also indicates that the mitigation schemes are very house-specific, and more than one mitigation method may have to be used to reduce radon to an acceptable level in a given house. Finally, methods to prevent radon from entering a house are most effective in reducing extremely elevated levels.

The information gained through research on 18 homes in Pennsylvania contributed to two Agency publications in August 1986: "Radon Reduction Methods: A Homeowner's Guide," and "Radon Reduction Techniques for Detached Houses: Technical Guidance." These publications will be revised in FY 1987 based on additional research in Pennsylvania, New Jersey, and New York.

For the next several years, EPA plans to continue the demonstration program in existing homes in the Reading Prong, and begin demonstrations in States outside of the Reading Prong to gain experience in a wider variety of housing types. In FY 1987, the Agency plans to conduct demonstrations

in up to 110 homes in Pennsylvania, New Jersey, New York, and up to three other States.

Thus far, the demonstration program has focused on active soil ventilation techniques. Most of the houses involved have had high radon levels (greater than 100 picoCuries per liter). In addition, some research has been done on heat recovery ventilators and methods for reducing radon in household water supplies. Research on these techniques will continue, and studies on passive soil ventilation techniques will be initiated. Future work will be directed towards houses with lower concentrations--levels in the 4 to 100 picoCuries per liter range--the range in which most affected houses fall.

To approach the demonstration program in a systematic manner, EPA has developed two matrices that enable the Agency to maximize the use of its resources and ensure that all the key variables in housing and mitigation technology are tested adequately. One matrix has been developed for existing houses and another for new houses. These matrices have been reviewed by the Agency's SAB, which supports their use. Each matrix includes various radon reduction techniques, initial radon levels, house substructure types, important house design features, soil characteristics, and other relevant factors. The cells in the matrix need to be filled with a minimum of five replicates each to achieve the confidence levels that homeowners are likely to want before they install a mitigation measure in their homes. EPA's current estimate is that at least 600 existing homes and 125 new houses will have to be tested to fulfill this objective.

EPA is developing and validating diagnostic protocols that researchers, States, and private contractors can use to determine mitigation approaches in houses. The protocols will also help EPA and others to collect comparable data from those who install and test the effectiveness of radon reduction techniques in houses.

(b) Apply and Evaluate Mitigation Methods

Once mitigation methods have been developed and demonstrated under research conditions in a selected number of houses, they must be more widely applied and evaluated in a large number of varied housing types under conditions likely to be faced by the average homeowner. To meet this need, the Agency has initiated a House Evaluation Program with three objectives: (1) to evaluate the cost and effectiveness of mitigation methods in the private sector; (2) to train State and private sector personnel in diagnosing and mitigating radon in houses; and (3) to provide feedback to the Agency's mitigation demonstration program.

In carrying out the objectives of this program, State personnel, in cooperation with EPA, diagnose a house with elevated radon levels and offer the homeowner several alternative mitigation schemes. In exchange for this service, the homeowner permits the State and EPA to obtain data on radon levels in the homes after the installation of control techniques. Thus, valuable information is gained on the cost-effectiveness of the installed techniques. An important facet of this program is the homeowner chooses whether to undertake the mitigation work, and is responsible for selecting the contractor. This is a significant difference between the house evaluation program and the Agency's demonstration program.

An additional benefit of this project is that it provides "hands-on" training in radon diagnosis and mitigation to State and local governments, and to private sector personnel, and promotes the use of local contractors to conduct mitigation work, thus expanding the cadre of experienced mitigation professionals. It is also expected that many homeowners will attempt mitigation on their own. The results of these efforts will provide information on the feasibility of radon mitigation being conducted by the homeowner, and will serve to better focus public information materials.

The Agency has already evaluated approximately 80 homes in Pennsylvania. During the remainder of FY 1987, EPA plans to evaluate up to another 150 homes in Pennsylvania, New Jersey, New York, and in States that may have identified problem areas through their survey efforts.

(c) Develop and Demonstrate Techniques to Prevent Radon Entry in New Construction

A critical element in reducing the health risk from radon exposure is to prevent radon entry in new construction. This can be accomplished by using specific building techniques. Some research has been conducted in this area by groups outside of EPA. The evidence clearly indicates that it is easier to prevent a radon problem before a house is built than it is to correct it afterwards. Thus, the Agency is designing a program for FY 1987 to conduct demonstrations in up to 25 new houses in New York and other States. The Agency is trying to situate the demonstrations on land that has the potential for causing radon problems and where the developer is willing to build preventive techniques into some of the houses while keeping others of the same design as controls. Generally, EPA will build in passive control measures, but will make it easy for the homeowner to use active soil ventilation techniques should they prove necessary.

The Agency is working closely with the housing industry, particularly the National Association of Home Builders (NAHB), to encourage their interest in this area. As part of a cooperative agreement, EPA and NAHB are putting together a pamphlet on preventive construction methods. This will be eventually followed-up with a technical manual describing in detail various construction practices to prevent radon entry.

(d) Develop Model Building Codes

The only way to ultimately ensure that prevention/mitigation techniques are incorporated into new construction practices is through modifications to local building codes. Florida has already passed legislation requiring the use of certain construction practices in houses built in certain areas of the State. Other States and localities are considering similar action. The Agency is working with the Council of American Building Officials and the three model code organizations to ensure that Agency efforts in the area of radon prevention are reflected in local building codes.

(e) Study Fundamentals and Devices

To assist the field demonstration on radon reduction in new and existing homes, certain aspects of radon mitigation require laboratory research.

The Agency is developing methods to evaluate the effectiveness of certain types of air cleaning systems. This work will have applicability to indoor air pollutants in general, as well as to radon decay products. Additional research needs include tests of sealants and coatings, and the development of standardized specifications for mitigation schemes, such as subslab ventilation systems. These needs, once met, will greatly enhance the development of private sector mitigation capabilities.

3. CAPABILITY DEVELOPMENT

(a) Provide Technical Assistance to the States

The objective of EPA's State assistance program is to encourage self-sufficiency within States as they address radon problems. The approach the Agency has taken is to transfer technical knowledge to State personnel and help them learn how to use it. EPA will show the States how to do the work, but will not do it for them. Similarly, EPA will provide them with technical support services, but will not offer long-term financial assistance. This effort has headquarters, laboratory, and regional components.

The types of assistance EPA provides to States may include:

- Designing and conducting State surveys;
- Hands-on experience in diagnostic evaluation;
- Consultation on development of State programs;
- Analytical services;
- Training courses and informational materials;
- Communications with affected communities; and
- Advice and technical information on radon mitigation.

Many States will require some or all of these types of assistance.

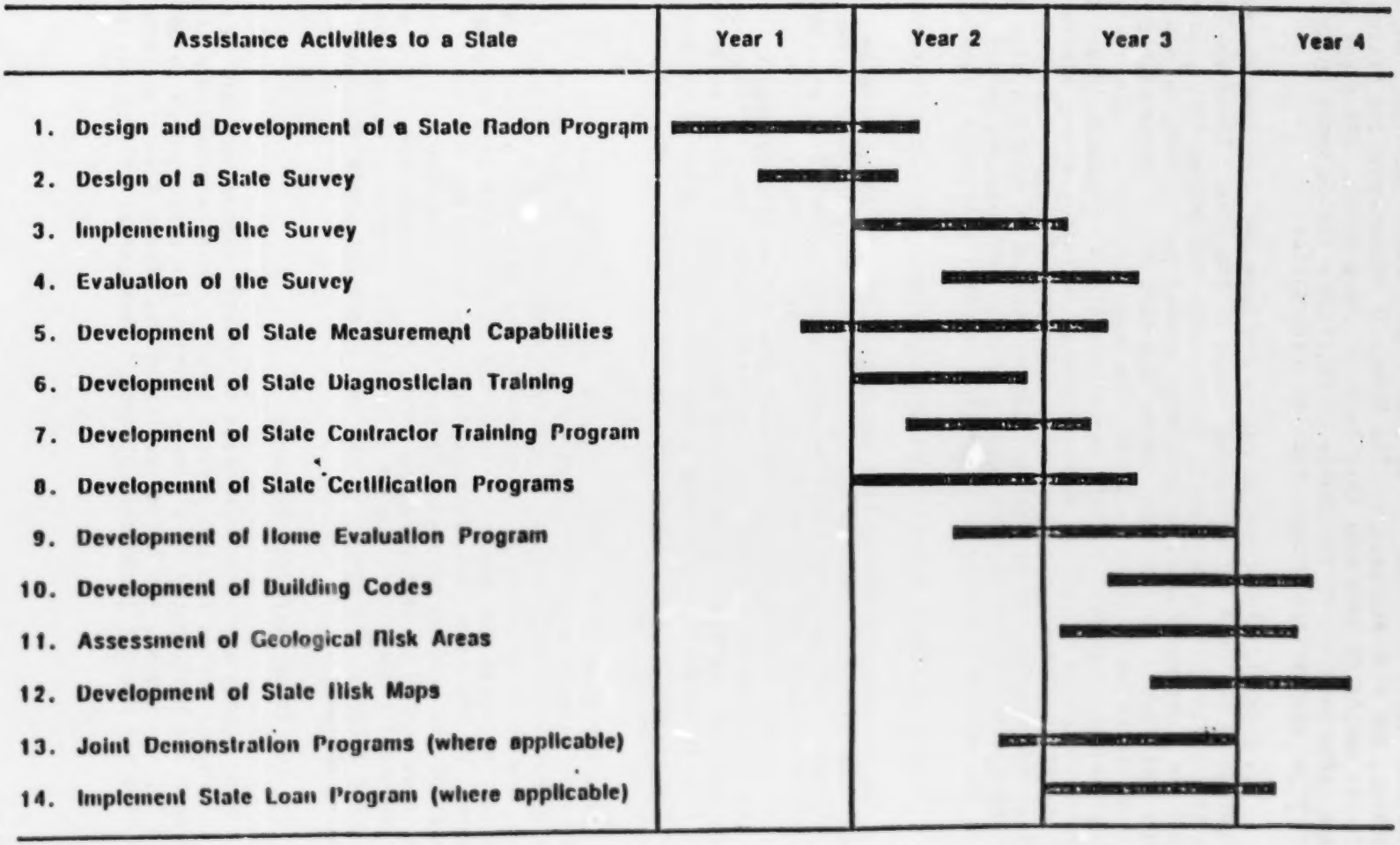
Table I indicates a typical workload for developing capabilities in a State. The tasks range from survey design to implementing a low-interest loan program if a State chooses this option to provide financial assistance to homeowners. Once a State discovers a radon problem, it must develop, in somewhat of a step progression, many of the capabilities described in Table 1. The Agency's experience with Pennsylvania, New Jersey, and New York indicates that States will need EPA assistance for two to five years. EPA currently is targeting resources to develop the types of capabilities indicated in Table I in the States affected by the Reading Prong, but is now beginning to move to States outside that area. It is likely that EPA will be required to provide State assistance over the next five to seven years.

(b) Conduct State Training Programs on Measurement Techniques, Risk Evaluation, and Remedial Methods

There is a great need for training both State and private sector organizations about various aspects of the radon problem. The Agency has developed a "Radon Diagnostician" training course which has been given approximately 20 times to State personnel and their private contractors. The course, which runs 3 days, presents the basics on the physical

TABLE 1

# Typical Workload for Developing Capabilities in a State


Assistance Activities to a State
Year 1
Year 2
Year 3
Year 4
1. Design and Development of a State Radon Program
2. Design of a State Survey
3. Implementing the Survey
4. Evaluation of the Survey
5. Development of State Measurement Capabilities
6. Development of State Diagnostician Training
7. Development of State Contractor Training Program
8. Developemnt of State Certification Programs
9. Development of Home Evaluation Program
10. Development of Building Codes
11. Assessment of Geological Risk Areas
12. Development of State Risk Maps
13. Joint Demonstration Programs (where applicable)
14. Implement State Loan Program (where applicable)

These activities may vary from State to State. Overall period of major involvement with a State may vary from two to five years.



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characteristics of radon, the available measurement techniques and mitigation methods, and risk evaluation. The Agency is encouraging the States and the private sector to take over this facet of the program. EPA plans to videotape large portions of the course to facilitate its delivery by the States and other appropriate groups, such as universities.

The diagnostician training course has been well-received and has highlighted the need for additional types of training. Since new developments are occurring almost daily in the radon mitigation field, there is a need for a one-day follow-up session to update participants on new mitigation techniques. In addition, there is a need for a longer course (perhaps a week) which would focus on actual "hands-on" mitigation experiences. The target audience primarily would be construction contractors interested in conducting radon mitigation work. There is currently a very limited cadre of qualified mitigation contractors, and demand for their services far outstrips the supply. By designing training courses to be eventually adopted by the States and the private sector, EPA can increase the number of mitigation professionals available to provide remedial services to homeowners.

(c) Implement a Quality Assurance Program for Radon Measurement

To reassure the public that radon measurements being made by commercial firms are accurate, the Agency established the Radon Measurement Proficiency (RMP) program to allow measurement companies to voluntarily demonstrate their ability to measure radon and its decay products. To assist in this effort, DOE shared with EPA its quality assurance facilities at its Environmental Measurement Laboratory in New York. EPA has recently developed the necessary capabilities at its Eastern Environmental Radiation Facility to conduct this program in-house. The RMP program has been quite successful, and several States are considering using it as part of their certification programs.

The RMP program is likely to continue to expand over the next year, with more vendors entering the market. The number of companies entering the market has almost tripled since the inception of the program in February 1986, and it is expected to increase over the next year or two. Therefore, EPA has increased the amount of resources committed to this program. However, at the same time, to conserve these resources, the number of rounds of the program offered have been reduced from four to two because of the large number of participating companies. Although the number of firms may eventually taper off, the need for the RMP program will continue well into the future. The Agency is evaluating whether there are other feasible funding options.

(d) Issue Technical Guidance

Many Agency activities generate technical information that is extremely useful to the States and the private sector. This information must be packaged and distributed in a timely fashion for these groups to benefit from it. In August, the Agency published its "Radon Reduction Techniques for Detached Houses: Technical Guidance." This manual will be revised and

updated in FY 1987. In addition, the Agency is preparing technical guidance for new home construction in cooperation with the NAHB. There will be a continuing need for these types of technical documents as new strides are made in the field.

(e) Establish a Federal Clearinghouse for Information on Assessing and Mitigating Exposure to Indoor Radon

A recent report issued by the U.S. General Accounting Office indicated the need for a Federal clearinghouse on radon.[4] Such a clearinghouse would collect and distribute information and research produced by the public, private, and academic sectors on radon. Because of the increasing volume of data, there is a growing need for a central collection point for information related to health effects, measurement data, radon prevention and mitigation techniques, etc. While the Agency recognizes this need as well, it has had to place a higher priority on first generating and disseminating information to assist the States and the public.

4. PUBLIC INFORMATION

There is a continuing need to work with the States to provide homeowners the information necessary to help them understand and evaluate the radon problem. An effective public information program is an essential component of EPA's approach to indoor radon. Last August, the Agency published two brochures, "A Citizen's Guide to Radon: What It Is and What to Do About It," and "Radon Reduction Methods: A Homeowner's Guide." Both are aimed at helping the general public understand indoor radon. These brochures have been adopted by a number of States and private sector organizations. Similar types of brochures directed at specific audiences or at other aspects of the radon problem are needed to supplement existing materials. The Agency is also working with private groups to develop educational materials or workshops for their members. In addition to these activities, the Agency expects to participate in various symposia, workshops, and public meetings.

5. FEDERAL COORDINATION

There is an active interest on the part of other Federal agencies to evaluate the problem of elevated radon concentrations in homes. The Department of Energy and the Department of Housing and Urban Development (HUD) have particular interest in the effects of radon on the indoor environment. DOE's energy conservation activities are balanced with efforts to assess and mitigate the effect of conservation on indoor radon levels. Further, DOE plans to enhance its radon basic research efforts in 1988 and is devoting an additional $10 million in the areas of health and biological effects and geological studies; EPA and DOE have cooperated in a research project on

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[4] Indoor Radon Air Pollution, Government Accounting Office. GAO-RDED-86-170, June 1986.

radon mitigation diagnostics. A copy of DOE's Radon Research Program Plan is attached as Appendix E. A draft memorandum of understanding between EPA and DOE on radon research and related technological activities is in its final form. HUD is mandated by statute to ensure that all HUD-assisted projects are located in safe and healthful environments. In this context, HUD is interested in developing inexpensive and effective mitigation techniques for new and existing houses.

These different agency concerns have led to the formation of several forums for the discussion of the indoor radon problem by interested Federal agencies. The CIAQ has a special workgroup to develop a coordinated Federal response to the radon problem. EPA and DOE co-chair this group, which has prepared a document which outlines the indoor radon issue, assesses current Federal research efforts, and identifies priority information needs. These priority tasks are consistent with those identified in this implementation plan.

In addition, the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), under the Office of Science and Technology Policy (OSTP), is examining the radon issue through its Radon Subpanel, which has reviewed the Federal government's activities on radon. The results of its findings are contained in "Radon Protection and Health Effects" published in August 1986. CIRRPC consists of representatives from 18 Federal agencies and a subcabinet level representative from OSTP. It is responsible for coordinating radiation matters among Federal agencies, evaluating radiation research, and providing OSTP with advice on issues of radiation policy.

Appendix: D

INDOOR AIR RESOURCE HISTORY

APPENDIX D

# EPA INDOOR AIR RESOURCE HISTORY

(Dollars in Thousands)

## Office of Research and Development

| | FY'84 | FY'85 | FY'86 | FY'87 | FY'88 |
|---|---|---|---|---|---|
| **Monitoring** | | | | | |
| FTE | -0- | -0- | -0- | 3.0 | 3.0 |
| S&E | -0- | -0- | -0- | 210.0 | 223.1 |
| R&D | $ 1,594.9 | $ 1,665.0 | $ 1,580.0 | $ 1,450.0 | $ 1,243.0 |
| TOTAL | $ 1,594.9 | $ 2,083.7 | $ 1,580.0 | $ 1,660.0 | $ 1,466.1 |
| **Health Effects** | | | | | |
| FTE | -0- | -0- | -0- | 1.7 | 1.0 |
| S&E | -0- | -0- | -0- | $ 100.0 | $ 100.0 |
| R&D | -0- | -0- | $ 150.0 | $ 550.0 | $ 550.0 |
| TOTAL | -0- | -0- | $ 150.0 | $ 650.0 | $ 650.0 |
| **Engineering** | | | | | |
| FTE | -0- | -0- | 4.6 | 6.0 | 6.0 |
| S&E | -0- | -0- | $ 238.0 | $ 320.4 | $ 340.0 |
| R&D | $ 427.0 | $ 285.0 | $ 290.0 | $ 220.0 | $ 370.0 |
| TOTAL | $ 427.0 | $ 285.0 | $ 528.0 | $ 540.4 | $ 710.0 |
| **TOTAL ORD PROGRAM** | | | | | |
| FTE | -0- | -0- | 4.6 | 10.7 | 10.0 |
| S&E | -0- | -0- | $ 238.0 | $ 630.4 | $ 663.1 |
| R&D | $ 2,021.9 | $ 2,083.7 | $ 2,020.0 | $ 2,220.0 | $ 1,863.0 |
| TOTAL | $ 2,021.9 | $ 2,083.7 | $ 2,258.0 | $ 2,850.4 | $ 2,826.1 |

## Office of Air and Radiation

| | FY'84 | FY'85 | FY'86 | FY'87 | FY'88 |
|---|---|---|---|---|---|
| FTE | -0- | -0- | 3.0 | 5.0 | 5.0 |
| S&E | -0- | -0- | $ 124.2 | $ 235.0 | $ 236.0 |
| EXTRAMURAL $$ | -0- | -0- | $ 50.0 | $ 200.0 | $ 200.0 |
| TOTAL | -0- | -0- | $ 174.2 | $ 435.0 | $ 436.0 |